ABSTRACT

ON THE RANDOM DISTANCE WITHIN AN AREA

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This paper examines the distance r between two points that are randomly distributed over a bounded area.

First, with respect to circular and quadrate areas, the probability density functions of r are obtained. After standardizing these two functions by making each expected value equal, next their forms are compared. From this comparison, it is revealed that these forms are almost the same. This fact may imply that the probability density function of r is almost independent of the form of an area. It may hence be not inappropriate to consider rectangular areas as a representative of various forms of areas.

Based upon this result, two kinds of approximation to the expected value of r are obtained. Let L be the perimeter of the minimum convex covering of an area. Then the first approximation is given by

$$E(r) \sim c_1 L ,$$

where c_1 is constant. The second approximation is given by

$$E(r) \sim c_2 R ,$$

where R is the diameter of the area and c_2 is constant.

These results are tested by using the forms of the 23 wards in Tokyo. Then $c_1=0.13$ and $c_2=0.33$ are obtained.